Damson carded.
Damson M. S. Dtu[illegible] S. P.
IMPERIAL MYCOLOGICAL INSTITUTE
1938

U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1398

CURRANTS AND GOOSEBERRIES

THEIR CULTURE AND RELATION TO WHITE-PINE BLISTER RUST

THE CURRANT AND GOOSEBERRY INDUSTRY must be considered in connection with the preservation of our valuable white pine timber. The white pines are a great national asset, essential to forestry development in this country.

White pine blister rust threatens to destroy these forests. This disease is caused by a destructive fungus of foreign origin introduced here between 1898 and 1910. It must first grow on the leaves of currant or gooseberry bushes before it can attack and kill the pines. The pines in an infested area can be protected from further damage from the rust only by removing all currant and gooseberry bushes from the area. Because of the blister rust, the culture of currants and gooseberries is restricted or prohibited in regions where the eastern and western white pines, sugar pine, and other five-needle (white) pines are important.

Cultivated black currants, sometimes called the European or English black currant (*Ribes nigrum* L.), are more susceptible to white pine blister rust than any other kind of currant or gooseberry. This species is the most active agent concerned in the long-distance spread and establishment of the disease. That is, cultivated black currant plants become heavily infected at great distances from diseased pines, and because of their extreme susceptibility to the rust they establish centers of infection from which the disease spreads rapidly to other kinds of currants, gooseberries, and white pines.

The United States Department of Agriculture recognizes the cultivated black currant as a distinct menace to the white pine timber supply of the country. It is a menace not only to the thousands of farm owners who grow white pine in their wood lots or in their shelter belts and dooryards but also to all citizens, since all use white pine lumber directly or indirectly. The cultivated black currant is so serious a danger to the production of white pine timber as to make this currant a public nuisance in all States where white (five-needle) pines grow. The Department is opposed to the growing of this species of currant (*Ribes nigrum*) anywhere in the United States and recommends that State authorities, nurserymen, and growers take active steps to accomplish its elimination from the Pacific, Rocky Mountain, Atlantic, Appalachian, Ohio Valley, upper Mississippi Valley, and Lake States.

The growing of cultivated black currants in home gardens, as well as in nurseries and commercial plantings, should be entirely abandoned throughout these States, because of the great importance of the white pines and the relatively small value of the black currants.

This bulletin is a revision of and supersedes Farmers' Bulletin 1024, Currants and Gooseberries

Washington, D. C.

Issued August 1924
Revised December 1934
Revised April 1938

CURRANTS AND GOOSEBERRIES: THEIR CULTURE AND RELATION TO WHITE PINE BLISTER RUST

By GEORGE M. DARROW, *senior pomologist, Division of Fruit and Vegetable Crops and Diseases*, and S. B. DETWEILER, formerly *principal pathologist in charge, Division of Blister Rust Control,*[1] *Bureau of Plant Industry.* With contributions by others

CONTENTS

	Page
Regions where currants and gooseberries can be grown	1
Cultural directions	3
Soil and site	3
Propagation of the plants	3
Handling nursery stock	4
Planting	5
Tillage and mulching	7
Interplanting and intercropping	8
Maintenance of fertility	9
Pruning the bushes	10
Injurious insects	11
The San Jose scale	11
The imported currant worm	15
The currant aphid	15
The currant borer	16
The currant fruit fly	16
Diseases	17
Currant diseases	17
Gooseberry diseases	18
White pine blister rust	19
Spray schedule for insects and diseases	25
Dormant treatment	25
Foliage treatment	25
Duration of a plantation	25
Harvesting the crop	26
Yields of fruit	27
Varieties	29
Currants	29
Gooseberries	31
Ways of using the fruit	32
Jellies	33
Jams	33
Unfermented juices	34
Other products	34
Summary of the more imporant State laws and regulations relating to blister-rust control	34
Information on Federal quarantine regulations	40
Interstate shipments	40
Importations from foreign countries	41

Before making a planting of currant or gooseberry bushes, persons interested should consider that the laws of several States restrict the planting of these bushes. (See p. 34.) Federal quarantine regulations also govern their interstate movement. (See p. 41.) The reason for these laws and quarantines is that currant and gooseberry plants are agencies in the spread of white pine blister rust, a destructive disease of five-leafed pines.

REGIONS WHERE CURRANTS AND GOOSEBERRIES CAN BE GROWN

FOUR FACTORS limit the growing of currants and gooseberries in the United States: The heat of summer, the lack of moisture, the white pine blister rust, and the currant maggot.

[1] The work of the Division of Blister Rust Control is now included in the Division of Plant Disease Eradication, Bureau of Entomology and Plant Quarantine.

Both currants and gooseberries are natives of cool, moist northern climates and in the United States succeed best in the northern half of the country and east of the one hundredth meridian. They are injured by the long hot summers of the Southern States, except in the higher altitudes of the Appalachian Mountains. Even in Missouri and Kansas they do not succeed very well. They are not adapted to the hot interior valleys of California, but are grown in the northern coast counties of that State. Figure 1 shows the approximate southern limit for the commercial culture of these fruits.

Gooseberries are grown slightly farther south than currants and seem to endure the summer heat somewhat better. More spraying, however, is necessary to keep the foliage of currants and gooseberries in a healthy condition in the southern part of their range than in the northern part.

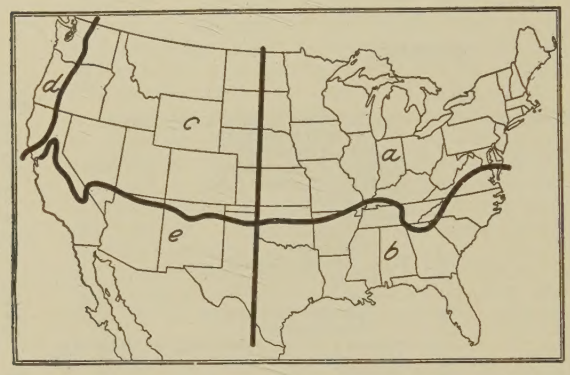

FIGURE 1.—Outline map of the United States, showing the regions where currants and gooseberries may be grown. The area marked *a* is naturally best adapted to currants and gooseberries; in *b* the summers are too long and too hot for these fruits; in *c* low rainfall limits their culture except under irrigation, though these fruits are planted in many dry-land fruit gardens throughout this region. Although the area marked *d* has sufficient rainfall for these fruits, most of the rain occurs during the winter months and the moisture must be carefully conserved, while *e* is both too dry and too hot in summer. The boundaries of these areas are not sharply defined, but grade imperceptibly into one another.

Currants and gooseberries are very hardy and withstand extremely low temperatures; in fact, if windbreaks are provided, most varieties are able to withstand the severe conditions in most parts of the upper Mississippi Valley and the northern Great Plains area.

In the region west of the one hundredth meridian, limited rainfall restricts their culture materially, except in irrigated sections and in comparatively small areas in northern California, the Willamette Valley, and the Puget Sound region.

The blister rust makes it necessary to destroy currant and gooseberry plants already growing and to prevent new plantings wherever the white pine is an important forest tree and there is danger of that disease being spread to valuable forest areas (see pp. 19 and 34).

The fruit worms, especially the currant maggot, are very serious pests on currants and gooseberries in the Mountain and Pacific Coast States and have made the production of these fruits difficult in many sections there. The currant maggot, for which there is no known means of control, occurs also in some localities in the Eastern States. Some very productive and profitable plantations may be found in the area designated as *c* in figure 1, and small plantings are scattered throughout the area, but until local conditions have been investigated, currants and gooseberries should not be planted commercially in that part of the country.

CULTURAL DIRECTIONS

SOIL AND SITE

The soil selected for the currant and the gooseberry should be cool, well drained, and fertile. The heavy types, such as silt or clay loams, are usually better in these respects than sandy soils. Neither fruit will do well on land where water stands during any part of the year.

In regions toward the southern limit of their culture, it is best to select a northern or northeastern slope, in order to give some protection from the sun. The north side of a building may be selected when only a few plants are to be grown for home use.

A place with good air drainage is preferred for gooseberries. In low, damp places, mildew attacks both fruit and foliage more severely than on higher sites where the air circulation is better. Currants, however, are seldom severely attacked by mildew. Therefore, when the site is a sloping one, currants may be planted on the lower parts and gooseberries above. As both fruits blossom very early in the spring, neither should be planted in low pockets where late spring frosts may kill the flowers.

Before planting, the soil should be prepared as for garden crops. This includes deep plowing and thorough harrowing. Recently plowed sod land should not be used, as a rule, because the sod will interfere with the setting of the plants and the management of the plantation until it becomes completely rotted. Sod land plowed early in the autumn and replowed and harrowed the following spring will usually be in good condition for planting, as will land in a good state of fertility following a crop of potatoes, tomatoes, or some other hoed crop.

PROPAGATION OF THE PLANTS

Plants of the varieties desired generally can be obtained from reliable nurserymen at small cost, and this is a satisfactory way to obtain them either for the home fruit garden or for commercial planting. They may be propagated in the home garden, however, by means of layers or cuttings.

Gooseberries ordinarily are propagated by mound layers. The plant from which layers are to be taken should be cut back heavily before it begins to grow in the spring. By July it will have sent out numerous vigorous shoots. It should then be mounded with earth half way to the tips of the shoots, as shown in figure 2. By autumn the shoots will have rooted. Those with strong roots may then be cut off and set in the nursery, to be grown for 1 or 2 years before planting in the field. If the roots are not well developed, it will be better to leave the shoots attached to the parent plant for a second year. They will make strong root systems meanwhile, and then, if grown for a year in the nursery after being cut from the parent plant, they will be satisfactory for planting. The latter method is more common with European varieties, which do not root so readily as the American sorts.

A few varieties of gooseberries are propagated more easily by cuttings than by layers. Those varieties which are of European parentage are generally the most difficult to propagate by cuttings.

American sorts vary greatly in this respect, however. Thus, cuttings of the Houghton variety root readily, while those of the Downing do not. Two new and as yet little-known varieties, the Poorman and the Van Fleet, are easily propagated by cuttings. If cuttings are used, they should be of the current season's growth and about 8 inches long, and they should be handled in accordance with the directions here given for currant cuttings.

FIGURE 2.—A field of gooseberries mounded for propagation by layers. About July 1 the bushes are mounded with soil at least half-way to the ends of the branches, following which roots begin forming along the branches. All those which are well rooted may be cut off from the parent plant in the autumn or the following spring and grown in the nursery row for one season, or perhaps two seasons, before being permanently planted. (Photographed at Fredonia, N. Y., Aug. 10, 1917.)

Currants are propagated almost entirely by means of cuttings made from vigorous shoots of the current season's growth.

In the Eastern States cuttings are made about 8 inches long and in the Pacific coast regions from 10 to 12 inches long. They are usually cut in the autumn after the leaves have dropped, and may be set in the nursery row immediately, or buried in sand with the bottom end up, or stored until spring in a cellar cool enough to keep them dormant and moist enough to prevent drying, but not so moist as to cause mold to develop on them. The cuttings may also be made during the winter or in early spring. In the latter case, they are put in the nursery at once. The cuttings should be set from 3 to 6 inches apart in the nursery row, with the soil firmly packed about them. This is done as early in the spring as the soil can be worked, whether the cuttings are made in the autumn or later. Not more than two buds should be left above the ground. Figure 3 shows cuttings placed in a trench ready to have the soil packed about them. At the end of one or two seasons they should make plants satisfactory for setting in the field. Figure 4 shows a currant bush used for propagation. All the new wood is removed each year to make cuttings.

HANDLING NURSERY STOCK

Only strong 1-year-old or 2-year-old plants from cuttings should be used for field planting. Unless the plants can be set at once upon

arrival from the nursery, the bundle should be opened and the plants separated and heeled in, as shown in figure 5. This will protect the roots from drying. If the roots are very dry when the plants are received, they should be soaked for several hours before being heeled in. Figure 6 shows a bundle of gooseberry plants as received from the nursery.

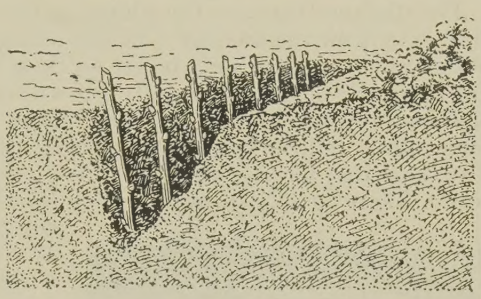

FIGURE 3.—Cuttings set in trench.

PLANTING

In most sections plants may be set either in the autumn or in the spring, but in northern Iowa and Nebraska and the States north of them only spring planting should be practiced. Both currants and gooseberries start growth very early in the spring, and if nursery stock can be procured in the autumn, the fall season is preferred for planting except in the section just mentioned. In order that the roots may become thoroughly established in the soil before winter, the

FIGURE 4.—A Cherry currant bush at Fredonia, N. Y., the entire annual growth of which has been cut off each year at the surface of the ground for use as cuttings. This practice insures the maximum growth of new wood for cuttings the following year. Nurserymen may get as many as 100 cuttings from a single bush. (Photographed Aug. 10, 1917.)

plants should be set as early as it is possible to obtain them in a dormant condition. Currants may be planted as early as the middle of September in the Northern States, except as noted above, and gooseberries as early as October 1. It is often difficult, however, to purchase plants for autumn setting.

The spacing of the rows depends mainly on the type of tools that are to be used for cultivation. If a 1-horse cultivator is to be used, the rows should be set 6 feet apart, while for a 2-horse cultivator the rows should be 8 feet apart.

The distance between the plants in the rows depends to a considerable extent on the variety. If the bushes are of a variety that does not grow large, they may be set as close as 4 feet, while if the bushes are naturally large when fully grown, or the ground is very rich, 5 or 6 feet apart is preferred. The bushes of the Wilder, London, and some other red currants grow larger than those of the Perfection, Fay, and Red Cross varieties, and should be set farther apart in the row. Therefore, if in any section Red Cross bushes are commonly set 5 feet apart in the row, the Wilder bushes should be at least 6 feet apart.

The Downing, Houghton, Oregon, and Poorman gooseberries have larger bushes than most others. They may be set 4 or 5 feet apart in soil of ordinary fertility, but in very fertile soil they will need to be 6 or 7 feet apart. Gooseberry bushes of European parentage usually do not grow so large as those mentioned, which are believed to be at least partly of American ancestry, and it is rarely necessary to set them more than 5 feet apart.

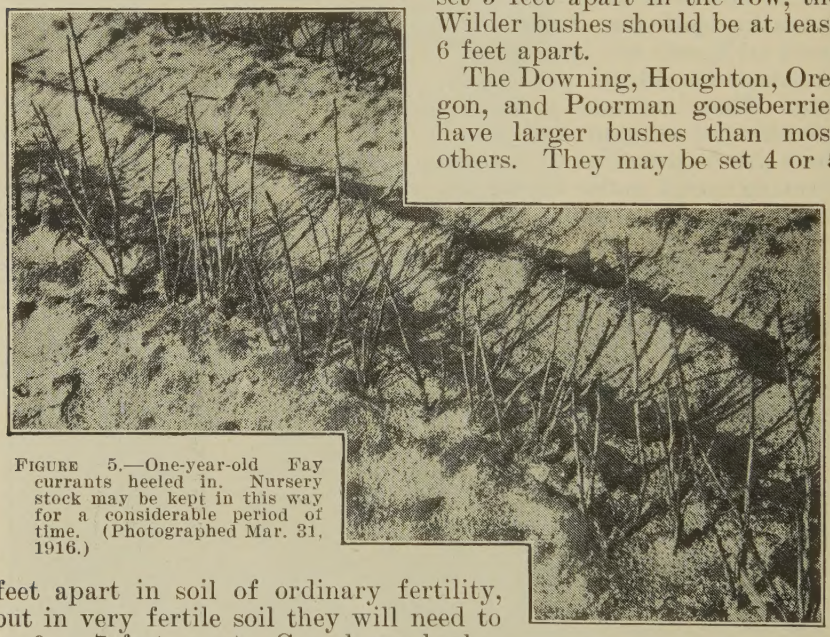

FIGURE 5.—One-year-old Fay currants heeled in. Nursery stock may be kept in this way for a considerable period of time. (Photographed Mar. 31, 1916.)

Before planting, all broken roots should be cut off and the top cut back to stand about 6 inches above the ground. If the plants have especially strong root systems the tops may be left 10 to 12 inches high. The plants should be set somewhat deeper than they stood in the nursery. If they do not branch naturally near the surface of the ground, they should be set so deep that the lowest branch starts just below the surface of the soil. This will cause them to take the form of a bush instead of a small tree.

The soil must be packed firmly about the roots, with the foot, as the plants are set. Without such packing the roots may dry out and the plants die.

In friable soils, such as fine sandy loams, the hole for planting may be made by forcing a spade straight down and then pressing it for-

ward. The roots are thrust into this hole, the spade withdrawn, and the soil firmed about them. Plants can be set very rapidly in this manner. In heavy soils holes may have to be dug with a spade before planting. The cost is then much greater than by the former method, but unless the holes are dug the clay may harden about the roots so that the plants will not grow well.

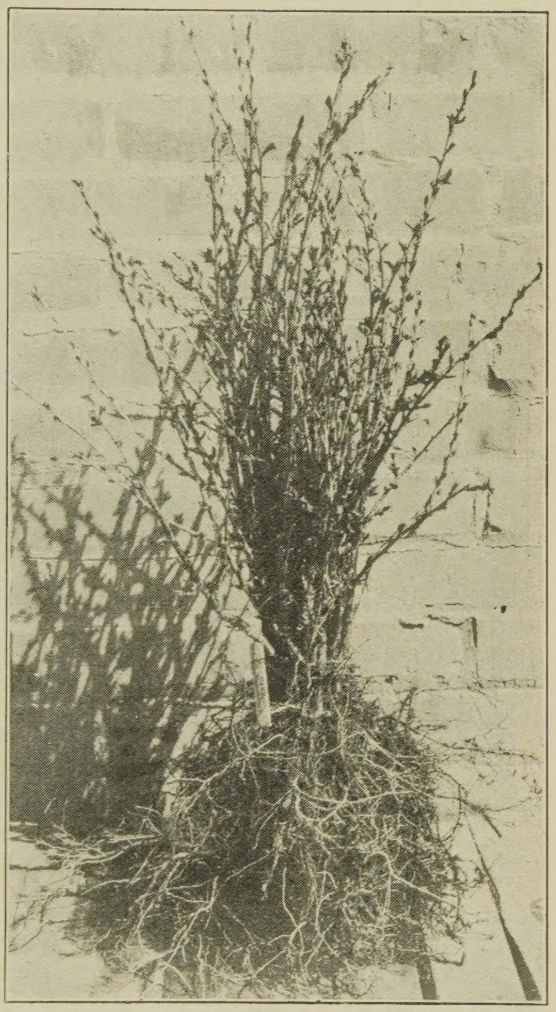

FIGURE 6.—A bundle of 27 good plants of the Carrie gooseberry as received from the nursery

TILLAGE AND MULCHING

Tillage should begin soon after the plants have been set and should be continued at frequent intervals throughout the growing season or until a green-manure crop is planted. The tillage should be deeper the first year than later.

Both currants and gooseberries usually are shallow rooted, and care must be taken not to injure the roots in tillage. If a cultivator is run rather deep the first year, the roots may be made to grow somewhat deeper than they otherwise would. The first spring cultivation should be deeper than later ones. Growers sometimes use a plow at this time.

Figure 7 shows the root systems of gooseberry plants grown on land properly tilled. Some of the roots were not more than 6 inches below the surface, but many were over a foot deep.

If plants are set 5 or more feet apart each way, a horse cultivator may be used, and very little hand hoeing will be necessary. If they are set so that the cultivator can be run in one direction only and the rows are 7 or 8 feet apart, a horse hoe, such as is shown in figure 8, may be used. This is easily guided, and if used in connection with the cultivator will reduce the amount of hand labor very considerably.

A mulch of straw or wild hay is sometimes advised for currants and gooseberries. It conserves moisture, keeps down weeds, and takes the place of tillage. Mice are likely to nest in mulched fields, however,

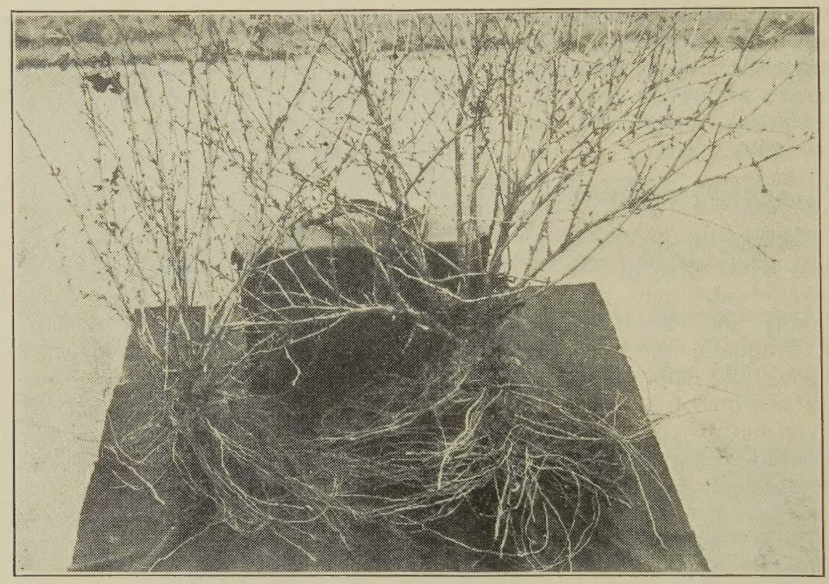

FIGURE 7.—An old gooseberry plant (at the right), showing the character of its root system. (The plant at the left grew from the tip of one of its branches, which was covered with soil.) (Photographed Sept. 26, 1916.)

and girdle the plants; in fact, the injury from this source is so often serious that growers rarely use a mulch.

INTERPLANTING AND INTERCROPPING

Gooseberries and currants frequently are interplanted in orchards or vineyards. Figure 9 shows gooseberries in a vineyard.

When interplanted in cherry orchards, gooseberries and currants may be left for several years, according to the growth of the orchard and the size of the bushes; and in apple and pear orchards they may be left somewhat longer, though the ground occupied should be restricted to one or two rows of bushes through the center of the space between the tree rows. Otherwise, the bushes will be likely to interfere with the proper care of the trees. In vineyards the currants and gooseberries are often made a part of the permanent plantation, but while they are commonly productive when so grown the grapes are likely to be rather unproductive.

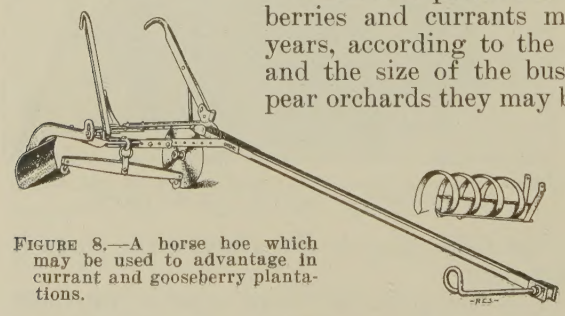

FIGURE 8.—A horse hoe which may be used to advantage in currant and gooseberry plantations.

In the gardens where space is limited, currants and gooseberries may well be planted among the tree fruits and left there permanently. The shade of the trees protects the fruits from sun scald, and the foliage is usually healthier in such locations than when grown where it is freely exposed to the sun. The shade afforded by the fruit trees will be especially beneficial in southern sections, and the currants and gooseberries should be even more productive than if planted by themselves.

When currants and gooseberries are not grown in orchards they may be intercropped for the first 2 years; that is, vegetables may be grown between the plants in the rows and between the rows. Lettuce, early potatoes, early cabbage, and other early crops requiring intensive cultivation are especially suitable for this purpose. The

FIGURE 9.—Gooseberries interplanted in a vineyard at Marlboro, N. Y. A row of gooseberries is set between the rows of grapes and another row under the grape trellis. These grape rows are 9 feet apart. (Photographed July 20, 1917.)

thorough tillage required by the vegetables is also needed by the berry plants, and the intercrop will often pay for all expenses connected with the care of the plantation.

MAINTENANCE OF FERTILITY

Both the currant and the gooseberry respond well to the use of fertilizers, even when planted on fertile soils. Their use, however, is governed by the same principles that apply to other crops. The kinds and quantities of the different plant foods that can profitably be used depend on the physical condition of the soil and the plant foods already available in it. The needs in any particular case can be determined only by applying the different plant foods separately and in various combinations to different parts of the plantation and noting the results. Thus, while stable manure and wood ashes can

be used in liberal quantities and will generally prove profitable, each grower must determine for himself the amounts that will give the best results on his soil. In like manner the kind and quantity of commercial fertilizer to be used must be determined.

Where a supply is available, 10 to 20 tons of stable manure per acre each year may be profitable, and some successful growers use even larger quantities. Many growers use hen manure. Larger quantities of this may be applied safely to gooseberry plantations than to currants.

In many sections green-manure or cover crops may be used to keep up the humus supply. The seed is sown or drilled in between the rows early enough to allow good growth before winter, and the crop is plowed under early the following spring. If this practice is followed, less stable manure or commercial fertilizer will be needed. The green-manure crops should be those best adapted to local conditions. Preferably, however, they should consist of legumes or a combination of legumes and nonleguminous plants.

FIGURE 10.—A currant bush before pruning.

PRUNING THE BUSHES

Currants and gooseberries naturally form bushes with many branches which start out near the surface of the ground, as shown in figure 10. Too many branches are usually formed. Pruning in a new plantation consists in removing the superfluous ones. It is only rarely that the branches are headed back. The pruning should be done during the dormant period. If this is not done following the dropping of the leaves in the autumn, it is frequently delayed until spring, shortly before growth starts.

PRUNING CURRANTS

Red or white currant bushes when 1 year old should have the weaker shoots removed, and six to eight strong shoots should be left, according to the vigor of the bush. At the end of the next year, four or five 2-year-old shoots and three or four 1-year-old shoots should be left, and at the end of the third year about three shoots each of 3-year-old, 2-year-old, and 1-year-old wood.

The red and white currants bear their fruit at the base of 1-year-old wood and on spurs on older wood. They bear best on spurs on 2-year-old and 3-year-old wood. Pruning bearing bushes after they are more than 3 years of age consequently consists in removing all branches more than 3 years old which have passed this heavy-bearing period, leaving just enough 1-year-old shoots to take their places. Pruning, therefore, in effect is a process of renewal.

In pruning varieties of spreading growth, the outer and lower shoots generally should be removed, as these branches are likely to

droop to the ground so that the fruit borne on them will become covered with dirt. Varieties having an erect habit of growth, on the other hand, should be thinned by the removal of the central shoots. Figures 10 and 11 show a currant bush before and after pruning, illustrating the method described.

PRUNING GOOSEBERRIES

The general principles of currant pruning apply also to gooseberries. The fruit is produced on 1-year-old wood and on 1-year-old spurs of older wood. Pruning consists in removing branches after they have borne fruit for 2 years and allowing new shoots to replace them. On the Pacific coast, however, the practice is to allow a branch to fruit for 3 years before removing it. It is said in that region that the canes are most productive the third year, after which they should be removed. If the side shoots become too numerous, enough of them should be cut out to form a fairly open head. Branches that have borne heavily tend to droop, and these, as well as all other drooping branches, should be removed.

Figures 12 and 13 show a 1-year-old gooseberry bush before and after pruning, while figures 14 and 15 show an older gooseberry bush before and after pruning. This bush was so vigorous that more than nine branches were left.

FIGURE 11.—The currant bush shown in figure 10 after being pruned.

Plantations of gooseberries trained to the tree form, where all the branches start from a main stem at a height of 1 or 2 feet above the ground, have been comparatively unproductive in the United States. Since the bush form, where all the branches start from the root at or just below the surface of the ground, is more productive, and since the gooseberry naturally grows in that form, it is the only one considered here.

Figure 16 shows a gooseberry plant grown in the tree form and figure 17 one in bush form.

INJURIOUS INSECTS[2]

THE SAN JOSE SCALE

The San Jose scale (*Aspidiotus perniciosus* Comstock) is sometimes destructive to currants and gooseberries. Infested plants become yellowish and unthrifty, many of the canes eventually dying. Plants seriously attacked have a grayish appearance, as if coated with ashes. Individual mature female scales are about the size of a pinhead, circular in outline, with a nipplelike prominence in the center (fig. 18).

[2] Prepared by A. L. Quaintance, formerly Associate Chief, Bureau of Entomology, in charge of the Division of Deciduous-Fruit Insects. Revised by B. A. Porter in May 1934.

FIGURE 12.—A gooseberry bush before being pruned. (Compare with fig. 13.)

FIGURE 13.—The gooseberry bush shown in figure 12 after being pruned. All branches lying on or close to the ground have been removed and those remaining have been thinned out.

FIGURE 14.—A 2-year-old gooseberry bush before being pruned. See figure 15. (Photographed Oct. 22, 1915.)

FIGURE 15.—The 2-year-old gooseberry bush shown in figure 14, after being pruned. The branches lying on the ground were removed and the top thinned. (Photographed Oct. 22, 1915.)

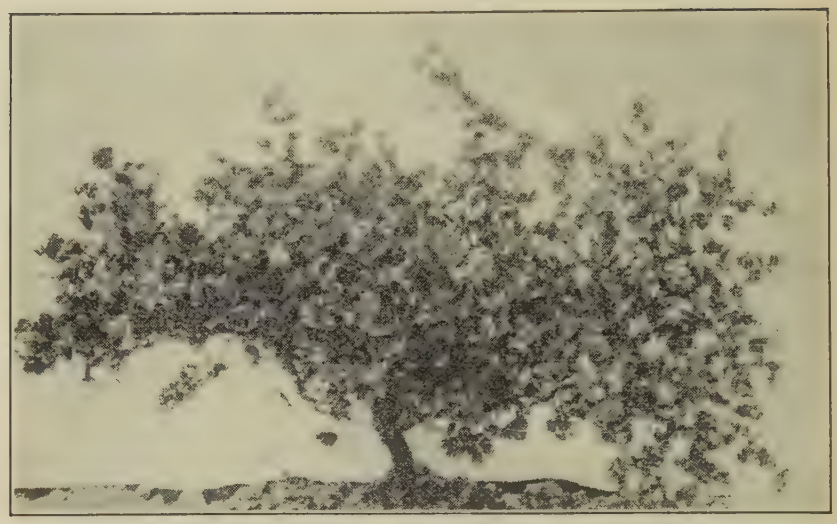

FIGURE 16.—A plant of the Jolly Angler gooseberry at Geneva, N. Y., trained to the tree form. This form is not so desirable as the bush form shown in figure 17. (Photographed July 23, 1917.)

FIGURE 17.—A plant of the May Duke gooseberry at Geneva, N. Y., trained to the bush form. The branches start at or below the surface of the ground. (Photographed July 23, 1917.)

Thorough spraying of the infested plants each year, during the dormant period, with lime-sulphur concentrate, at the rate of 1 gallon to 7 or 8 gallons of water, with 2-percent to 4-percent lubricating-oil emulsion, or with miscible oils as recommended by the manufacturer, will keep these insects under control, as well as the oyster-shell scale (*Lepidosaphes ulmi* L.), also common on currants.

THE IMPORTED CURRANT WORM

The imported currant worm (*Pteronidea ribesii* Scopoli), when full-grown, is about three-fourths of an inch long, green throughout, but yellowish at the ends. Young larvae are covered with black spots, and the head is black (fig. 19). These worms attack both currants and gooseberries, appearing on the plants shortly after the leaves are out in the spring. They feed at first in colonies, but later scatter over the plants. Currant worms are voracious feeders and quickly strip the plants of foliage; hence, treatment should be given promptly upon their discovery. Another brood of larvae appears in the early summer, and in some seasons there may be a partial third brood. These insects are destroyed readily with an arsenical spray (such as lead arsenate 1 pound to 50 gallons of water), or by dusting the plants with lead arsenate (10 or 15 percent of the powder to 85 or 90 percent of hydrated lime or gypsum as a filler). Effort should be made to destroy the first brood and prevent later injury. Whenever fruit is present, powdered hellebore should be substituted for lead arsenate. The hellebore, for dusting, should be diluted 5 to 10 times with flour or air-slaked lime, or as a spray, 1 ounce to 1 gallon of water should be used.

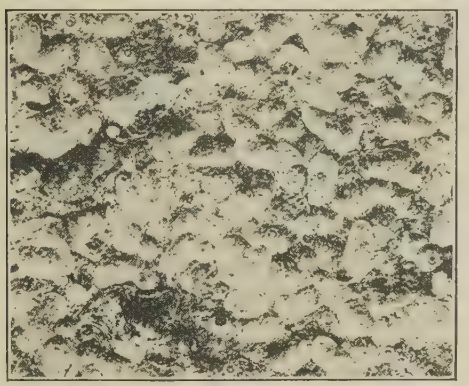

FIGURE 18.—The San Jose scale (much enlarged).

FIGURE 19.—The imported currant worm and its injury to currant leaves.

THE CURRANT APHID

The currant aphid (*Myzus ribis* L.) curls the terminal leaves of the currant and gooseberry, especially the red currant; its presence results in little pits or pockets on the lower leaf surface (fig. 20).

A reddish color usually develops on the upper surface of injured leaves, which can be seen some distance away. This aphid is easily controlled by spraying the plants as the leaf buds are opening in the spring, thus destroying the young stem mothers. The 40-percent nicotine sulphate at the rate of 1 part to 800 or 1,000 parts of soapy water should be used. Where the nicotine is used in small quantities, 1 teaspoonful to a gallon of water, or 1 ounce to 8 gallons, makes the right proportion. In spraying later in the season the liquid should be directed against the insects on the lower surface of the leaves.

THE CURRANT BORER

The larvae of the currant borer (*Synanthedon tipuliformis* Clerck) attack the canes, principally of the currant, eating out the pith, the hollows or burrows often being several inches in length. The injured canes put out a sickly growth in the spring, owing to their weakened condition, and may be broken by the wind.

FIGURE 20.—Currant leaves curled by the currant aphid.

The parent insect is a handsome clear-winged moth, with a wing expanse of about three-fourths of an inch. These insects are out during June and deposit their brownish round eggs singly on the plants. The resulting larvae bore into the canes and tunnel up and down as they grow, becoming nearly full grown by fall. They are then about half an inch long and whitish, with brown head and legs. The larvae hibernate in their burrows, complete their growth the following spring, and then pupate. In May or early June the moths emerge, completing the life cycle of the insect.

This pest is best controlled by cutting out and destroying in the spring the sickly and weakened canes. If this work is carefully done each year, it will aid much in keeping the insects reduced below injurious numbers.

THE CURRANT FRUIT FLY

The maggot of the currant fruit fly (*Epochra canadensis* Loew) infests the fruit of both the currant and gooseberry, causing it to color prematurely and usually to fall to the ground. Infested berries generally have a discolored spot at the place punctured by the female in depositing the egg or marking the location of injured seeds. This insect occurs in Canada and the northern part of the United States, but is more troublesome in the West, where in some regions it is practically a chronic pest. The maggots require about 3 weeks to complete their growth. Then they leave the berries, either while these are hanging on the plants or after they have fallen to the

ground, change to the pupal stage at or below the ground surface, and remain in this condition until the spring following, when the adults appear as small pale-yellowish flies and deposit eggs in the developing fruit.

No practical method of controlling this pest is known. Benefit, of course, according to the thoroughness with which the work is done, will follow the careful removal from the bushes and destruction of the prematurely ripening fruit.

DISEASES[3]

The fungus diseases of the currant and the gooseberry are much the same and are rather generally distributed throughout the areas where these plants are grown. Descriptions of the most important diseases follow, including a special discussion of white pine blister rust.

CURRANT DISEASES

CANE WILT

The fungus (*Botryosphæria ribis* Gross. and Dug.) causing cane wilt usually enters the plant through a terminal or lateral bud or a small branch on a cane and soon reaches the main stem, completely cutting off the water supply of the upper part and causing the leaves and fruit to wilt and die. The death of the cane may occur at any time during the growing season, but is most frequent and conspicuous about the time the fruit is ripening. This disease at present appears to be confined chiefly to New York and New Jersey. No noticeable difference in the susceptibility of different varieties has been observed.

Treatment.—The attempts to prevent or control this disease have not been very successful thus far. A combination of eradication and spraying is the best treatment that can be recommended. As a sanitary measure, all diseased canes should be cut out and burned as soon as discovered, and in the fall all canes dead and dying from any cause should be removed and burned. In addition to this, the spray treatment with bordeaux mixture given under "Spray schedule" for anthracnose and leaf spot should help to prevent new infections. The dormant spray with lime-sulphur for scale insects should also be helpful.

ANTHRACNOSE

Anthracnose is caused by a parasitic fungus (*Pseudopeziza ribis* (Lib.) Kleb.) which at first produces numerous small brownish spots thickly scattered over the upper surface of the leaves. As the disease progresses, the leaves turn yellow and drop. In severe cases the bushes may be defoliated before the fruit has ripened. Sometimes also the fruitstalk and fruits are attacked by the fungus. In less severe cases the foliage may not fall until after the fruit has matured. The canes, however, do not mature properly in either case and are much weakened and more liable to winter injury and fungus diseases than normal vigorous canes. Some varieties are more subject to attack by this disease than others. The Albert

[3] Prepared by C. L. Shear, formerly principal pathologist in charge, Division of Mycology and Disease Survey, Bureau of Plant Industry.

(*Prince Albert*) and the Wilder varieties are said to be usually free from attack, while the Fay and the Victoria are likely to be badly affected.

Treatment.—The dormant spray with commercial lime-sulphur, 1 to 10, as commonly used for scale insects, is very helpful in controlling anthracnose. During the growing season the plants should be sprayed with bordeaux mixture according to the spray schedule given on page 25. In severe cases it may be necessary to spray after the fruit has been picked, in order to prevent premature defoliation. Spraying just before the fruit is ripe may result in staining and necessitate washing.

LEAF SPOT

Leaf spot (*Septoria ribis* Desm.) is characterized by the appearance of irregular spots having a pale center and brownish-purple margins. Minute brownish-black pustules of the fungus are produced on the under sides of the spots on the leaf. These pustules are the fruiting bodies of the parasite. The spots may become so numerous on the leaves that the plants are more or less defoliated. This trouble is not often as serious as in the case of anthracnose, and the leaves do not usually fall until late in the season. Where there is defoliation, however, there is injury to the plant and a decrease in its productivity.

Treatment.—The treatment for leaf spot is the same as that for anthracnose, as given in the spray schedule on page 25.

ANGULAR LEAF SPOT

Angular leaf spot (*Cercospora angulata* Wint.) is usually less frequent and less serious than the other leaf troubles. The spots produced by the fungus are scattered, roundish or angular, and ashy or whitish.

Treatment.—The spray treatment recommended for anthracnose will also prevent angular leaf spot. (See spray schedule.)

POWDERY MILDEW

Besides the diseases above mentioned, powdery mildew of the gooseberry sometimes occurs on the currant, but it is rarely of sufficient importance to require treatment.

GOOSEBERRY DISEASES

POWDERY MILDEW

Powdery mildew (*Sphaerotheca mors-uvae* (Schw.) B. and C.) is not usually severe on American varieties of the gooseberry. It is most serious on European varieties or hybrids with European varieties. The fungus first appears in the form of a white, more or less powdery growth on the young leaves and shoots as well as fruit. As it develops further it forms a thin, felty, reddish-brown coating of fungus filaments on the fruit, foliage, and stems.

Treatment.—The most satisfactory treatment for powdery mildew is commercial lime-sulphur, 1½ gallons to 50 gallons of water. Three or four applications should be made, as soon as the leaf buds begin to open, and repeated at intervals of 10 to 14 days. Where the attack is severe, the diseased tips of the canes should be cut out and burned, as the fungus lives over winter in these diseased parts.

ANTHRACNOSE

Anthracnose (*Pseudopeziza ribis* (Lib.) Kleb.) of the gooseberry is caused by the same fungus and has the same general appearance as anthracnose of the currrant. It is, however, usually less serious on the gooseberry.

Treatment.—Spraying with bordeaux mixture, in accordance with the directions in the spray schedule for currant anthracnose, will control this disease.

LEAF SPOT

Leaf spot (*Septoria ribis* Desm.) has practically the same appearance on the gooseberry as on the currant and is caused by the same fungus. It sometimes causes the plant to lose its leaves.

Treatment.—It can be controlled by giving the treatment directed in the spray schedule for currant leaf spot.

WHITE PINE BLISTER RUST[4]

White pine blister rust is a destructive disease of white pines, brought into the United States between 1898 and 1910 on white pine planting stock imported from Europe.

It is now established in the New England States, New York, Pennsylvania, New Jersey, Maryland, Virginia, West Virginia, Ohio, Iowa, Michigan, Wisconsin, Minnesota, Montana, Idaho, Oregon, and Washington. It is also in the Canadian Provinces of Nova Scotia, New Brunswick, Prince Edward Island, Quebec, Ontario, and British Columbia.

Currants and gooseberries, both wild and cultivated, are the chief agencies in the spread of this disease. For this reason the currant and gooseberry industry must be considered in connection with the preservation of the white pine timber supply.

The white pine is one of the most valuable timber trees of the United States. It grows rapidly, produces a high yield of excellent lumber, and is found over vast areas in both eastern and western parts of the country. The standing white pine in the United States is valued at over $400,000,000.

The term "white pine" includes all the 5-needle pines, the most important of which are the northern white pine, western white pine, and sugar pine.[5] The wood of these species is first choice for a great variety of uses and has been important in the agricultural and industrial development of the United States. The white pines are favorite ornamental trees and are widely used for shade and shelter belts where they are not primarily important for timber. For such uses they often possess a value in some respects far greater than their

[4] Slightly revised in the Division of Plant Disease Eradication, Bureau of Entomology and Plant Quarantine.

[5] The white pines native to North America are: (1) Northern white pine (*Pinus strobus*); (2) western white or silver pine (*P. monticola*); (3) sugar pine (*P. lambertiana*); (4) limber pine (*P. flexilis*); (5) white bark pine (*P. albicaulis*); (6) bristlecone pine (*P. aristata*); (7) foxtail pine (*P. balfouriana*); (8) Mexican white pine (*P. strobiformis*).

timber value, but in general their greatest value lies in their capacity to produce highly profitable timber crops under forest management. The practice of forestry in the United States will be very seriously handicapped if blister rust is not controlled.

White pine blister rust cannot be eradicated from North America, but its spread can be delayed, and local control applied, to the extent to which the public cooperates in combating the disease. The growers of currants and gooseberries should know the main facts regarding this disease so they can cooperate intelligently with State and Federal Governments in its control.[6]

WHAT CAUSES BLISTER RUST AND HOW IT SPREADS

The blister rust is caused by a parasitic fungus which grows on the leaves of currants and gooseberries and then attacks and kills white (five-needle) pines. In order to attack a pine tree, it must first undergo an intermediate development on the foliage of the currant or gooseberry. It cannot pass directly from a diseased pine tree to a healthy one. A diseased pine tree can infect no other plants with the rust except currants and gooseberries.

The regions where currants and gooseberries thrive best are also the regions most favorable for the white pines and have climatic conditions well suited to the rapid development of the blister rust. The disease is highly destructive to white pines wherever currants and gooseberries are grown.

BLISTER RUST ON WHITE PINES

The blister rust first attacks the needles and young twigs of a pine tree. It grows in the inner bark and kills by girdling. Trees of every size are destroyed, sometimes by direct infection of every twig and branch on the tree, but usually the fungus gradually grows back from one or more infected twigs into the trunk and girdles it. The rust lives and grows in the pine bark from year to year until the tree dies.

Early in the spring of the third or fourth year after a pine tree is attacked by the rust, orange-colored blisters burst through the diseased bark and usually continue to do so each spring as long as the diseased tree remains alive. These blisters are about the size of a navy bean and contain immense numbers of dustlike spores so small and light in weight that they can be carried many miles—in some cases hundreds of miles—by the wind. These spores of the blister rust correspond to the seeds of other plants. They may retain their power of germination for several months, but the only "soil" in which they can grow is the foliage of currant and gooseberry bushes.

This fact is important and it is repeated for the sake of emphasis that the blister rust spores produced on white pine trees cannot infect other pines or any other plants except currants and gooseberries.

[6] For a discussion of the origin and nature of white pine blister rust, see U. S. Department of Agriculture Miscellaneous Publication 22, Protect White Pine from Blister Rust.

BLISTER RUST ON CURRANTS AND GOOSEBERRIES

When the spores from a diseased pine fall on either a currant or gooseberry leaf, they may germinate or sprout, grow into the leaf tissue, and produce a rust. This is the currant rust, or the summer stage of the blister rust fungus. It appears as tiny orange-colored pustules on the under side of the infected leaf. These pustules are filled with spores which can infect currant and gooseberry bushes, but no other plants. The rust spreads from bush to bush through successive generations of the summer stage, new generations coming on at intervals of 10 to 14 days from early June until the leaves fall in the autumn. Each succeeding generation intensifies the rust locally on currants and gooseberries, and by repeated jumps the disease may reach currant and gooseberry bushes at a considerable distance from bushes infected earlier. The spores of the summer stage are somewhat sticky and are readily carried by insects, birds, and animals, as well as by the wind. Since the spores of this stage may retain their infecting power for a week to several months, the possibility of the long-distance spread of the rust during the course of a season is evident.

The cultivated black currant (*Ribes nigrum* L., the European black currant) is the favorite host of the blister rust. As compared with it, other species of currants and gooseberries are relatively resistant to infection, but after it is infected the rust spreads to other currants and gooseberries. The cultivated black currant has many characteristics which favor infection. It is a plant of exceptionally vigorous growth, has large leaves and luxuriant foliage, and produces new shoots and leaves to a maximum late in the season; that is, it has a large leaf surface on which spores of the rust may be produced in large numbers. It is a tall bush, grows in the open, and is an excellent target for the reception of wind-blown spores. A diseased cultivated black currant plant usually produces three or four times as many of the spores which infect white pines as are known to be produced by any other currant or gooseberry, and hundreds of times as many as are produced by most varieties.

TRANSFER OF BLISTER RUST FROM CURRANTS AND GOOSEBERRIES BACK TO THE PINE

The summer stage of the rust on currants or gooseberries is harmless to white pine trees, but from late June to the end of the growing season the rust develops another stage on currant or gooseberry leaves which enables the disease to pass back to the pine. In this last stage, as in the preceding stages, the rust forms spores which are readily transported by the wind. However, these pine-infecting spores retain their power to germinate for only a very brief period after being blown from the currant leaf, instead of remaining alive for weeks or months, as is the case with the spores in the other stages. The spores that transmit the rust to pine are so delicate and short-lived that infected currant or gooseberry bushes, with the exception of cultivated black currants, have not been found to cause commercial damage to pines beyond a distance of 900 feet from where they are located. This must not be confused with the spread from pine to currant, which is many miles.

CONTROL MEASURES TO PROTECT PINE STANDS

The white pine blister rust can be controlled because there are two weak points in its life cycle.

It cannot spread to the pines without first growing on currant and gooseberry plants, and these produce pine-infecting spores of very short life.

To protect white pines from damage by the rust, it is only necessary to destroy the currant and gooseberry bushes within a short radius of the pines. The exact distance varies with local conditions, but ordinarily 900 feet is a safe distance to separate pines from currants and gooseberries—if cultivated black currants are absent. In the Eastern States pines standing more than 900 feet from currant and gooseberry bushes infected with blister rust have not suffered commercial damage from the disease except when the rust spreads from cultivated black currants. Wild currant and gooseberry bushes are commonly found growing with the pines. Local control of the blister rust is accomplished by pulling up all wild and cultivated currant and gooseberry bushes within 900 feet of the pines to be protected.

The destruction of entire patches and plantations of cultivated currants and gooseberries growing within 900 feet of valuable white pine is necessary to control the rust effectively. To destroy only the infected individual bushes is impracticable, because the rust spreads from one bush to another and it is impossible to find every infected bush in time to prevent its spread to other bushes. In addition to this, cultivated black currants generally must be eradicated. Local control can be applied by individual landowners but is most effective on a community basis.

CONTROL MEASURES TO PROTECT PINES IN NURSERIES

It is especially important that white pines grown for sale should have more protection than is considered necessary for commercial stands. The loss of a single pine will not cause serious damage to a commercial planting. On the other hand, an infected pine in a nursery if shipped into a disease-free area might be the means of establishing a new center of infection. Therefore white pine in nurseries should be safeguarded by the eradication of European black currants for 1 mile and other currant and gooseberry plants for 1,500 feet.

CONTROL MEASURES TO PROTECT CURRANTS AND GOOSEBERRIES

In regions that are infected, there is no practicable method by which the grower can protect currants and gooseberries from the rust. Many experiments with spraying have been tried, but none has been successful in preventing infection or in killing the blister-rust fungus after it attacks the currant or gooseberry.

Cultivated bushes are not known to be killed by the blister rust, but those which are heavily infected lose their leaves in midseason, and the crop is seriously reduced. Different kinds of currants and gooseberries differ greatly in the degree of their susceptibility to the rust.

The greatest protection to currant and gooseberry growers, as well as pine owners, is afforded by the general destruction of cultivated black-currant (*Ribes nigrum* L., the European black currant) plants throughout the country.

The blister rust was introduced into the United States in relatively recent years, and there are many States and localities into which it has not yet spread. It is important to keep the disease out of disease-free regions as long as possible and to delay its progress in regions where it has begun its ravages. To accomplish this, the destruction of cultivated black currants in all States where white pines occur is an exceedingly important general control measure.

WHY CULTIVATED BLACK CURRANTS SHOULD BE DESTROYED

The common cultivated black currant is the nurse plant of the blister rust. This plant, in the vast majority of cases, has been the outpost in the spread of white pine blister rust; that is, it has been the first to become infected with the disease and at points farthest from infected pines. In the Northwest, cultivated black currants have become infected with the rust at distances up to 150 miles or more from the nearest infected pines.

These bushes, because of their extreme susceptibility to the rust, become diseased at great distances from infected pines, and then rapidly infect the more resistant species of currants and gooseberries growing near them. Black currants thus establish centers from which the rust continues its spread by repeated jumps to all kinds of currant and gooseberry plants, infecting large numbers of bushes over a considerable extent of territory and then spreading to the pines.

White pines are popular ornamental trees and are extensively planted outside of commercial pine-growing regions. For this reason white pine trees are frequently located near gardens in which currants and gooseberries are growing and they become infected with blister rust as a result of the general spread of the disease on the currant and gooseberry bushes. A new center of pine infection is thereby established, from which the disease spreads again to distant cultivated black currants.

Field conditions have uniformly shown that if there had been no cultivated black currant bushes the white pine blister rust would not be so widely established in America as it is today.

In order to have white pines it is necessary to sacrifice cultivated black currants. The cultivated black currant is of no great commercial value in this country. While it may be successfully grown on a small scale in some regions, the market demands for this fruit are limited, and in general it is less profitable to grow than the red currant. That it is prized in individual cases is, of course, fully understood.

The United States Department of Agriculture recognizes the cultivated black currant as a distinct menace to the white-pine timber supply of the country. It is a menace not only to the thousands of farm owners who grow white pines in their wood lots or in their shelter belts and dooryards, but also to all citizens, since all use white-pine lumber, directly or indirectly. The cultivated black cur-

rant so seriously threatens the production of white-pine timber as to make it a public nuisance in all States where white—five-needle—pines grow. The Department of Agriculture is opposed to the growing of the European black currant (*Ribes nigrum* L.) anywhere in the United States, and recommends that State authorities, nurserymen, and growers take active steps to eliminate it from the Pacific, Rocky Mountain, Atlantic, Appalachian, Ohio Valley, upper Mississippi Valley, and Lake States (fig. 21).

Growing cultivated black currants, in home gardens as well as in nurseries and commercial plantings, should be entirely abandoned throughout these States because of the great importance of the native and planted white pines and the relatively small economic value of the cultivated black currant. There are some individuals to

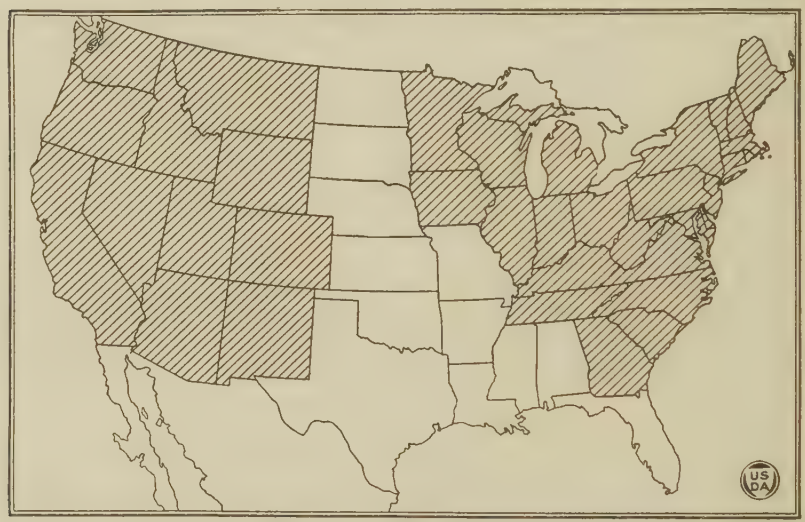

FIGURE 21.—Outline map of the United States, showing by diagonal lines the regions where the cultivated black currant (*Ribes nigrum*) should not be grown.

whom the loss of the cultivated black currants will mean a measurable sacrifice. But the menace of the blister rust to our white-pine forests demands this sacrifice in the regions named.

CONSULT THE STATE NURSERY INSPECTOR BEFORE PLANTING CURRANTS AND GOOSEBERRIES

The invasion of North America by the white pine blister rust has resulted in the issuance by many States of regulations governing the planting or possession of currant and gooseberry bushes. A summary of these regulations is appended (p. 41), but changes are constantly being made, owing to changes in the blister-rust situation.

The prospective planter should not purchase black currant plants, and before investing in stock of other kinds of currants and gooseberries he should communicate with the nursery inspector in his State regarding the requirements. A number of States have enacted laws authorizing State officials to compel the destruction of currants and

gooseberries in certain districts or in the entire State and to prohibit the planting of currants and gooseberries in control districts.

HELP TO SAVE OUR WHITE-PINE FORESTS

The white pines are a great national asset, essential to forestry development in this country. In view of the value of our white-pine forests and the loss in wealth and in productive power of our forest lands which will result if blister rust is not controlled, every citizen should aid in saving the pines.

The blister rust presents a national problem, which can be solved only by the hearty cooperation of growers of currants and gooseberries.

SPRAY SCHEDULE FOR INSECTS AND DISEASES

DORMANT TREATMENT

Just as the buds begin to swell, spray with lime-sulphur concentrate at the rate of 1 gallon to 7 or 8 gallons of water, with 2- to 4-percent lubricating-oil emulsion, or with miscible oils as recommended by the manufacturers. This is for the control of the San Jose and other scales.

FOLIAGE TREATMENT

FIRST APPLICATION

Just as the leaves are unfolding in the spring, spray with bordeaux mixture, 4–4–50.[7] This treatment is for cane wilt, anthracnose, and leaf spot. If aphids are present, add nicotine sulphate (containing 40 percent nicotine) 1 to 800 to 1 to 1,000.

SECOND APPLICATION

Ten to twelve days after the first treatment spray with bordeaux mixture, 4–4–50,[7] plus 1 pound of lead arsenate to 50 gallons of spray. This is for the control of the fungus diseases mentioned and also for the imported currant worm. If fruit is present, omit the lead arsenate and spray with powdered hellebore, 1 ounce in each gallon of water, or dust with the same material diluted 5 to 10 times with flour or air-slaked lime.

THIRD APPLICATION

Twelve days to two weeks later, the second treatment should be repeated.

NOTE.—In cases where the powdery mildew is serious, dilute lime-sulphur concentrate at the rate of 1½ gallons to 50 gallons of water should be used instead of bordeaux mixture, as previously stated.

DURATION OF A PLANTATION

If a currant or gooseberry plantation is properly cared for, at least 8 to 10 crops may be expected before it becomes unprofitable

[7] Copper sulphate (bluestone), 4 pounds; stone lime, 4 pounds; water to make 50 gallons of spray.

because of its age. Productive fields over 20 years old are not uncommon in some sections. Although the number of years a plantation will continue in good bearing condition depends to some extent upon location and soil, the most important factor is the care which it receives. The period of productiveness of both currant and gooseberry plants is longer in northern regions than toward the southern limits of their culture and longer on heavy soil than on sandy soil.

HARVESTING THE CROP

Currants and gooseberries may be left on the bushes for a long time after they are ready for use, from 4 to 6 weeks in the case of gooseberries and with some varieties of currants even longer. For fruit which is to be marketed, however, the picking season is shorter, its length depending upon the variety.

Fruit that is intended for the general market should be picked and handled with great care. Injury to the skin furnishes an opportunity for the development of molds and bacteria which cause the fruit to spoil very quickly. There is also in the case of currants a leakage of the juice, which makes them unattractive and causes dust and dirt to adhere to them.

Quart baskets are often used as containers in picking. They may be set in hand carriers or in waist carriers attached to the belt or suspended from the shoulders of the picker.

Currants should be picked by separating the stem of the cluster from the branches with the fingers and not by grasping the clusters of berries and pulling them off. The berries are easily crushed and should never be pressed in picking. Certain varieties develop no berries at the base of the fruit cluster, next to the branch or spur, and these can be picked easily without danger of crushing. This is an especially desirable characteristic in a variety grown for market purposes.

When currants are to be used for jelly, they should be slightly underripe, as in that stage of maturity the berries contain more pectin (the substance in the juice of fruit which enables it to form jelly) than when thoroughly ripe. This is especially necessary with the Perfection, Red Cross, and other sorts which become rather mild flavored when fully ripe. If the fruit is to be spiced, stewed, or used for jams, it should be fully ripe when picked.

In this country, gooseberries are usually picked before they are fully ripe. As soon as they are fully grown, which, in general, is about the time red raspberries begin to ripen, they may be picked for the canning factory or for jelly or jam making. When to be used for these purposes, they may be stripped by hand, or a scoop resembling a cranberry scoop may be employed in picking. Gloves are worn when stripping the berries from the branches. In stripping, the berries are mixed with leaves, which are cheaply removed by being passed through a grain-fanning mill, as shown in figure 22.

When gooseberries are intended for the general market they should not be stripped from the branches, as the sharp thorns cut many of the berries and these quickly spoil. Large-fruited sorts must be handled with special care in order to avoid injuries. When fancy

prices are obtained for these large sorts, the bushes are sometimes picked over twice. After the full-grown berries are removed at the first picking, the small ones increase rapidly in size and are ready for picking in a few days. They are usually marketed in quart baskets; more rarely in pint baskets.

In Europe large quantities of ripe gooseberries are eaten out of hand. Venders and fruit stores sell them in paper sacks and other containers, as cherries are sold in this country. In the United States, however, gooseberries are not commonly eaten without cooking, although many sorts are delicious when ripe and rank among the best dessert fruits. In fact, in this country gooseberries are used almost entirely in the green state. As gooseberries are of different

FIGURE 22.—A fanning mill through which gooseberries are being passed, as they are received from the pickers, for the purpose of removing the leaves that are mixed with them in picking. (Photographed June 16, 1915, at Rancocas, N. J.)

colors when ripe, and vary in their season of maturity, it will be necessary to learn by experience the proper time to pick each sort.

Gooseberries sun-scald very quickly after being picked and should be kept in the shade. Berries left in bright sunshine for half an hour, or even less, are likely to sun-scald badly.

Figures 23 and 24 show crates of currants and gooseberries ready for market.

YIELDS OF FRUIT

The currant, as a rule, bears abundant annual crops. Good plantations of gooseberries of European parentage should yield at least 100 bushels per acre. Those of American or partly American parentage are generally more productive, and yields of 300 bushels and more per acre are not unknown. European varieties, however, usually sell for much higher prices than American varieties.

FIGURE 23.—A 32-quart crate of Perfection currants ready for market. Note the relatively large size and long stems of this sort. (Photographed July 20, 1915, at Westwood, Mass.)

FIGURE 24.—A 32-quart crate of Columbus gooseberries at Middle Hope, N. Y. Note the large size of this variety, which is one of the most desirable of the European sorts. (Photographed June 23, 1915.)

Bushes in gardens usually receive more intensive cultivation than those in large plantations and therefore yield more as a rule. Currant bushes under garden conditions often yield 5 to 10 quarts each, and gooseberries even more.

VARIETIES

CURRANTS

For commercial plantations, vigorous, erect-growing, productive varieties of currants should be chosen. The more acid varieties should be selected for jelly making and the milder varieties for dessert uses. The fruit should be large and firm and borne in compact clusters. Deep-red varieties are preferred for the market. For dessert use in the home the white currants are considered best.

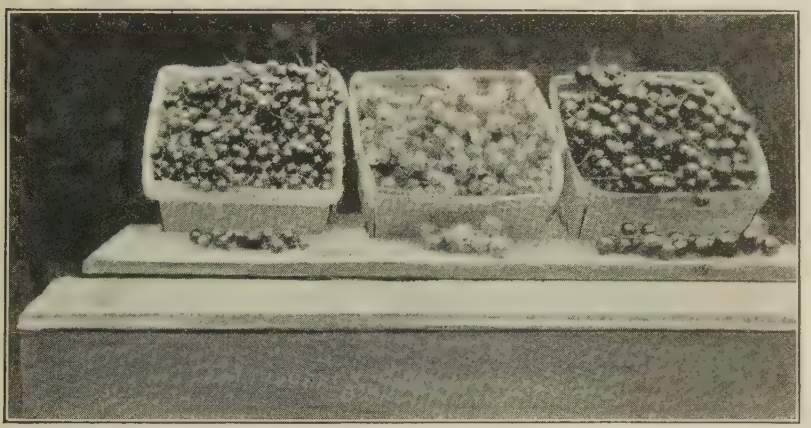

FIGURE 25.—Boxes of several varieties of currants, with clusters of each variety in the foreground. The varieties represented are (from left to right) the Albert (red), Margeson (white), and Perfection (red). (Photographed July 20, 1915, at Westwood, Mass.)

The following varieties are suggested for the sections named: Perfection, Wilder, Red Cross, and White Imperial for the northeastern part of the United States; London Market, Wilder, Red Cross, and Perfection for Michigan and other parts of the Middle West; Perfection, London Market, Red Cross, Wilder, Fay, and Victoria for the Pacific coast. Red Lake is a promising new sort for all regions.

In certain localities in the regions specified, other varieties may be better adapted. The Fay, Perfection, Cherry, White Grape, Red Cross, and London Market have been found entirely hardy in North Dakota and should be hardy anywhere in the United States.

Most growers prefer to plant but one or two varieties. If two varieties are used, an early and a late one are selected.

Figure 25 shows the character of the fruit of three varieties of currants, while figure 26 shows a branch with the characteristic short clusters of the black currants.

RED VARIETIES [8]

Albert (*Prince Albert, Rivers Late Red*).—Berries medium to large, hang on the bushes well, season very late; clusters of good size. Bush large, upright, stiff. Foliage abundant, dark green, resistant to disease, and remaining on the bushes until late. Productive and promising as an extra-late variety.

Cherry.—Berries large, becoming smaller as the bush grows older; deep red, very acid, midseason. Bush somewhat spreading. The genuine Cherry is unproductive.

Diploma.—Berries very large, bright glossy red, mild subacid; clusters easily picked. Bush upright, slightly spreading; canes rather brittle. Unexcelled for home use on account of its beauty and quality.

Fay.—Berries large, dark red, acid, early to midseason; clusters with small berries at the ends, easy to pick. Bush very spreading, canes easily broken; needs fertile soil. One of the leading varieties in New York.

FIGURE 26.—A branch of the Golden Prolific currant. This is a variety of the species *Ribes odoratum*, which is native to western Kansas and Oklahoma, eastern Colorado, and surrounding regions. Varieties of this species are very productive under some conditions, but under other conditions are unproductive. (Photographed June 30, 1917.)

Filler.—Berries large, bush upright; similar to the Fay, but preferred to that variety in the Hudson River Valley.

London Market (*London Red*).—Berries medium to large, deep red, rather acid, midseason to late; clusters compact, with short stems. Bush upright, somewhat resistant to borers and diseases; reported as the most resistant of any variety to the white pine blister rust. The best variety in many sections of the Middle West.

Long Bunch Holland (*Franco-German*).—Berries medium size, light red, acid, season very late; clusters long. Bush upright, vigorous; only moderately productive. Desirable for dry western climates.

Perfection.—Berries large, bright crimson, sprightly subacid, midseason; clusters compact, very long, easy to pick. A heavy yielder. Berries sometimes scald in hot weather if not picked as soon as ripe. Bush more or less spreading, throwing up few canes from below the ground; canes break easily. A very promising variety for all sections and the best variety in parts of the Northwest.

[8] The characterizations of red and white varieties of currants have been prepared in cooperation with Paul Thayer, formerly assistant horticulturist at the Ohio Agricultural Experiment Station.

Pomona.—Berries medium to large, light red, subacid, midseason to late; clusters long. Bush fairly vigorous, spreading; canes rather brittle. Very productive.

Red Cross.—Berries large, firm, light red, subacid, hang on bushes well; midseason, but later than Cherry; clusters of medium length, well filled, easy to pick. A desirable variety in most sections, although cracking so badly at one point in the Hudson River Valley that it has been discarded. Not so good for jelly as others.

Red Lake.—Minnesota origin. Berries large, firm, light red, subacid, late; clusters longest of any, easy to pick. Bush upright, vigorous, productive and very hardy. Promising new late variety with very large fruit and clusters.

Victoria (*Raby Castle*).—Berries medium size, bright red, mild subacid, hang well on bushes; clusters long, loose. Bush upright, large, very free from diseases and most insects, but susceptible to hot-weather injury in some sections. Very productive and very hardy. The Victoria, London Market, and Albert are valuable in prolonging the season.

Wilder.—Berries large, dark red, mild subacid, hang on bushes well, midseason; clusters large, compact, easy to pick. Bush upright and large. A desirable variety and hardy in all regions except the upper Mississippi Valley. The leading variety in the Hudson River Valley and Lake Erie fruit belt.

WHITE VARIETIES

White Grape.—Berries large, pale yellow, very mild flavor; clusters long, well filled. Bush very productive.

White Imperial.—Berries large, pale yellow, almost sweet; clusters medium length, loose. Bush spreading, very productive. A desirable variety; considered to have the best dessert quality of all currants.

NATIVE AMERICAN VARIETIES

Crandall.—Berries large, bluish black, with a characteristic flavor somewhat unlike other black sorts; clusters rather small. Bush spreading; succeeds in regions having hot summers. The Golden Prolific is a variety similar to the Crandall, but with golden fruit. The berries of both these sorts must be picked singly, as they do not all ripen at the same time. Though the fruit is bluish black, it should not be confused with the commonly cultivated black currants of European origin, such as Napes, Lee, and Boskoop, which are prohibited by quarantine from most of the United States. These are horticultural varieties of *Ribes nigrum*, while Crandall is a variety of the native species, *R. odoratum*. Both the Crandall and Golden Prolific, however, are under certain restrictions of the blister-rust quarantine (see p. 41) as to any interstate movement, and no one is permitted to ship them out of the rust-infected States.

GOOSEBERRIES

As already stated, the American varieties of gooseberries are usually the most productive. They are hardier and are considered by most Americans to be of better quality. Though the European varieties are larger and sell much better in the market, they are rather subject to mildew. However, the Poorman, a new native variety of large size, has proved to be widely adapted and is better in quality and more attractive than the European sorts. Abundance, Perry, and Pixwell are three new varieties introduced by the North Dakota Experiment Station and are promising in that region.

Figure 27 shows fruits of the Columbus, Industry, May Duke, Poorman, Downing, and Carrie varieties.

AMERICAN VARIETIES

Carrie.—Fruit small to medium, too small to be promising, red when ripe. Bush quite free from mildew, with few short thorns; very productive. Grown chiefly in Minnesota, Wisconsin, and neighboring States, where it is of value. In the Eastern States it greatly resembles the Houghton, but it is not recommended to replace that variety.

Downing.—Fruit large for an American sort, pale green. Bush rarely attacked by mildew; very productive. The most widely grown variety in the United States and liked better than other varieties for canning. Notably resistant to the aphids.

Houghton.—Fruit small, dark red. Bush more susceptible to mildew than the Downing, branches somewhat drooping; very productive. One of the most widely grown and productive varieties in the United States, but too small and not liked as well for canning as the Downing. Very susceptible to the aphids.

Josselyn (*Red Jacket*).—Fruit large for an American sort, reddish green. Bush productive, mildews in some localities; a promising variety in some localities in the Northeastern States.

Oregon (*Oregon Champion*).—Fruit large for an American sort, color green, season late. Bush very productive, rarely attacked by mildew. The best variety in the northwestern Rocky Mountain and Pacific Coast States and promising for all parts of the United States.

Poorman.—Fruit the largest of the American varieties, brilliant red when mature. Bush very vigorous, productive; thorns shorter and fewer and less objectionable than those of other varieties. In New York and Utah it is considered the best of all varieties. Promising for all parts of the United States.

FIGURE 27.—Gooseberries of different varieties, showing the relative sizes of the fruits. From left to right the individual fruits represent the Columbus, Industry, and May Duke (European sorts), and the Poorman, Downing, and Carrie (American sorts).

EUROPEAN VARIETIES

Chautauqua, Columbus, Portage, and Triumph.—These varieties are all very similar, even if not identical. Fruit very large, pale green. Bush in open localities does not mildew seriously; somewhat spreading, productive. Replacing American varieties to some extent because of their larger fruit; generally liked better than the Industry variety.

Industry.—Fruit very large, dark red, somewhat hairy. Bush upright, productive. Bush and fruit subject to mildew. Nursery stock of this variety should be in the bush rather than the tree form.

May Duke.—Fruit large, dark red; season early. Bush spreading, productive. This variety is recommended by the New York Agricultural Experiment Station as the best early gooseberry of European parentage.

WAYS OF USING THE FRUIT[9]

Currants and gooseberries are used chiefly in making jellies, jams, preserves, pies, and tarts, rather than fresh. Both fruits are rich in pectin and acid, which are necessary for jelly making. Gooseberries are also a general favorite for jam, and when combined with raspberries, currants, or other fruits they make even better jam than when used alone. The flavor, texture, and color of jams and jellies made from these fruits are best when the fruits are cooked as rapidly as possible.

[9] Prepared by Louise Stanley, Chief, Bureau of Home Economics.

Black currants are especially prized for making jam. Varieties of black currants of European parentage are considered better than those of American origin, which lose some of their distinctive flavor during cooking.

In making jellies, jams, and other products from these fruits the following points are important.

JELLIES

Jelly of the best quality is easily made from either currants or gooseberries. For making jelly, pick the fruits before they are entirely ripe. Wash the fruit, but do not remove it from the stems. After mashing it, add a small quantity of water, heat to the boiling point, and cook rapidly until the skins turn a light color; then pour into a jelly bag to drip. As soon as the juice ceases to drip, turn the pomace back into the kettle, barely cover it with water, boil again, and extract the juice exactly as the first time. The two extractions may be used separately or combined. If they are combined, use equal volumes of juice and sugar for making the jelly. If the extractions are made up separately into jelly, use equal proportions of first-extraction juice and sugar, and use three-fourths as much sugar as second-extraction juice. From very high-grade currants, juice may be extracted a third time. In that case, combine the second and third extractions and use three-fourths as much sugar as currant juice.

After the sugar and juice are combined, stir until the sugar is dissolved. Then boil rapidly until the sirup no longer runs off the spoon in a steady stream, but separates into two distinct lines of drops, which "sheet" together. Pour into sterilized glasses and when jellied cover with melted paraffin.

JAMS

For making jam, select sound, ripe currants and gooseberries, and wash them well. Remove the stem and blossom end from gooseberries and pull the currants from their stems.

To each pound of the prepared fruit, use three-fourths of a pound of sugar. Crush the fruit, add the sugar, and stir constantly until the sugar is dissolved. Then boil rapidly until the mixture no longer runs off the spoon in a steady stream, but separates into two distinct lines of drops which "sheet" together, and stir often to prevent sticking to the pan. When cold, jams become thicker and the juice forms jelly; therefore, care should be taken not to overcook them. Pour the hot jam into sterilized jars and seal tightly.

If the currant seeds are objectionable, boil the fruit until it is soft and press through a sieve to remove the seeds before adding the sugar.

The following combinations of fruit are suggested for variety: Equal quantities of currants and raspberries; equal quantities of gooseberries and blackberries; two-thirds blackberries and one-third gooseberries; equal quantities of gooseberries and currants.

UNFERMENTED JUICES

Unfermented juices of gooseberries and currants can be used, either separately or combined with each other or with the juices of other fruits, for making jelly or beverages.

Use sound, clean, ripe currants and unripe gooseberries. Extract the juice as for jelly making. Strain through a flannel cloth and place in bottles or fruit jars. Put the jars or bottles in a water bath and heat the juice almost to the boiling point, but do not boil. A temperature of 180° F. is desirable. Hold the juice at this temperature for 20 minutes, seal, and then remove from the water bath. Store the juice in a cool place.

OTHER PRODUCTS

Currants and gooseberries are used for making conserves, preserves, pastes, marmalades, spiced products, catchups, and for canning. Gooseberry tarts and pies made of green gooseberries or green currants are especially popular.

SUMMARY OF THE MORE IMPORTANT STATE LAWS AND REGULATIONS[10] RELATING TO BLISTER RUST CONTROL[11]

(In effect October 1936)

The following summary gives information as to the legal action taken by the various States to protect their white-pine stands from damage by white-pine blister rust. It will be noted that a number of these States have established control areas wherein currant or gooseberry plants may not be grown. These areas are subject to change from time to time. They are likely to be extended, or new ones may be established in other States. Before obtaining currant and gooseberry bushes, the prospective planter should therefore consult the State plant-pest control official, whose address is provided herein, to ascertain whether there are areas in the State within which such bushes may not be planted. He should also take into consideration the Federal quarantine regulations governing the interstate movement of these plants.

CALIFORNIA

The cultivated black currant (*Ribes nigrum*) is declared a public nuisance, and it is unlawful to grow or distribute this plant in the State. The State director of agriculture and the county agricultural commissioners may abate the nuisance in a summary manner or otherwise. Wild currants (*Ribes* sp.) are designated as weeds, and the director may, after investigation and practical survey, proclaim an area within the State to be practically free from them. It is unlawful for anyone owning or possessing land in such an area to permit the wild currant to mature upon his land and disseminate its seed or to propagate itself by other means thereon or on the land of another. For further information address the Bureau of Plant Quarantine, Sacramento, Calif.

CONNECTICUT

It is unlawful to grow, plant, propagate, cultivate, sell, transport, or possess any plant, root, or cutting of the European black currant (*Ribes nigrum*),

[10] For quarantine regulations, see p. 40.

[11] Compiled by Maude A. Thompson, assistant in domestic plant quarantines, Bureau of Entomology and Plant Quarantine. Copies were made available for approval by the responsible official of each State concerned.

and the director of the Connecticut Agricultural Experiment Station is authorized to seize and destroy any such plants found in the State. The law authorizes the director or his representatives to enter upon any public or private grounds in the performance of their duties and to uproot and destroy all currant and gooseberry bushes and white pines infected with the blister rust. The director is also authorized to designate, and has so designated, districts within which all currant and gooseberry bushes, either cultivated or wild, may be uprooted and destroyed. These districts surround certain nurseries growing white pine in several towns in the State. For further information address the State Entomologist, Agricultural Experiment Station, New Haven, Conn.

IDAHO

Black currants (*Ribes nigrum* and its varieties) are proclaimed a public nuisance, and it is unlawful to possess or sell them. Horticultural inspectors are ordered to condemn and destroy any black currants in the State. The law provides that plants that are known to be hosts of any injurious disease shall be eradicated by the owner or person in charge of the property concerned when he is officially instructed to do so. In case he fails to perform such work in the time specified the State is authorized to destroy the designated plants, the expense becoming a legal charge upon the property. A quarantine has been established prohibiting the planting, possession, or transportation of currant and gooseberry plants within several counties in northern Idaho. For further information address the Director, Bureau of Plant Industry, Boise, Idaho.

ILLINOIS

Plants infected with injurious diseases, or plants which are not essential to the welfare of the people and which may be favorable hosts of diseases destructively injurious to essential plants, are declared a nuisance. Landowners and others are required to keep their places free from such nuisance. The department of agriculture may, after public hearing, give public notice of the species of plant to be destroyed and the section from which it is to be eradicated. If the responsible persons fail to destroy such plants by the method and within the time specified, the department is authorized to abate the nuisance and shall collect the expenses incurred, together with all costs, by an action in debt in the name of the people of the State of Illinois against the person liable. The department has power to inspect any place on which it has reason to suppose such a nuisance is being maintained.

Any plant material brought into the State in violation of proclamations of the Governor or regulations of the department of agriculture, or in violation of Federal plant quarantines, shall, at the expense of the owner, be destroyed or returned, or otherwise disposed of as the department may direct. For further information address the Chief Plant Inspector, Urbana, Ill.

IOWA

Inspectors have free access to any place which it may be desirable to enter in carrying out the provisions of the Iowa Crop Pest Act, and whenever plants are found infested or infected with any dangerously injurious pest or disease listed by the State entomologist as a public nuisance, written notice shall be given the owner with instructions as to control of the pest or removal or destruction of the plants. Every person who knows of the existence in any place of such pest or disease shall report it to the entomologist. Any material received in the State in violation of any State or Federal quarantine may be seized by State inspectors and destroyed or returned. For further information address the State Entomologist, Ames, Iowa.

KENTUCKY

Within white-pine growing districts, as designated by the State entomologist, all wild currant and gooseberry bushes, as well as cultivated ones at abandoned or unoccupied houses, are declared a nuisance and may be removed by authorized agents of the department of agriculture when growing within 1,500 feet of valuable pine forests. The counties of Menifee, Morgan, Powell, and Wolfe are designated as white-pine growing districts, and others may be added as need arises. For further information address the State Entomologist, Lexington, Ky.

MAINE

Currant and gooseberry plants and white pines infected with the blister rust are declared a public menace, and the forest commissioner and his representatives have the right to enter upon any private or public lands within the State and destroy any such plants or any wild currant or gooseberry bushes. Several counties in the State have been designated as control areas within which landowners may be required to destroy such bushes and pines so infected, and on failure to do so are taxed the cost of removal. They may also be required to destroy the above-named plants, within these areas, even though not infected with the rust. The State nursery inspector is also authorized to enter upon any land in the vicinity of a nursery and to enforce measures of control or eradication of plant pests, including white-pine blister rust. For further information address the State Horticulturist, Augusta, Maine.

MARYLAND

The law providing for the suppression and control of insect pests and plant diseases authorizes duly appointed inspectors to enter upon public premises and private land and to inspect for, destroy, or experiment with injuriously dangerous insect pests or plant diseases. Owners or tenants are given written notice of plants so infested, and if they fail to treat or destroy them the work is done by the State representatives and the expense collected through the State attorney. White-pine blister rust control areas have been established in which no currant or gooseberry plants may be introduced or possessed. White-pine forests, plantings, or nurseries may be accepted, when feasible, by the State horticultural department as blister rust control areas within 1 mile of which no black currant plants may be grown, or within 1,500 feet of which no currant or gooseberry plants of any species may be grown. For further information address the State Plant Pathologist, College Park, Md.

MASSACHUSETTS

Officials of the division of plant-pest control are authorized to enter upon any public or private property in the performance of their duties. The law provides for the destruction of all currant and gooseberry bushes and five-leafed pines infected with the blister rust or so situated as to be liable to infection. The law further provides that the director of the division may, with the approval of the commissioner of agriculture, prescribe such general requirements as may be needed for carrying out the law relating to the control of plant pests. Under this provision of the law, notice has been given that all European black currants (*Ribes nigrum*) in the State are to be destroyed, and the possession, sale, transportation, or further planting of currant and gooseberry bushes of any kind is prohibited in over 200 townships in Massachusetts. For further information address the Division of Plant-Pest Control, Statehouse, Boston, Mass.

MICHIGAN

White-pine blister rust is declared a dangerous forest pest under Public Act 313, approved May 24, 1929. Plants infected with this disease, as well as all wild currant and gooseberry bushes, may be destroyed by order of the commissioner of agriculture. Any currant or gooseberry plants or white pines not so infected may also be destroyed where necessary in carrying out the purposes of this act. The cultivated black currant (*Ribes nigrum*) is declared a public nuisance, and the planting, possession, or sale of these plants within the State is prohibited. The commissioner is also authorized to designate "fruiting currant and gooseberry control areas * * * where currants and gooseberries are grown on a commercial scale and where their value is clearly greater than the use of the area for the production of white pine." No white pine may be planted within such areas without written permission of the commissioner. He may also designate, and has designated, other control areas for the protection of white pine from damage by the blister rust, and no currant or gooseberry bushes may be planted therein without written permission of the commissioner. It is the duty of landowners within both such areas to carry out the control measures ordered. The commissioner and his agents have the right to enter upon any lands to determine the presence or absence of white-

pine blister rust and to carry out measures for its control. For further information address Orchard and Nursery Inspection, State Department of Agriculture, Lansing, Mich.

MINNESOTA

The commissioner of conservation may designate areas within the State in which measures to control white-pine blister rust are necessary or advisable, and all currants and gooseberries or white pine may be ordered destroyed in such designated areas. The State nursery inspector is also authorized to enter upon any land in the vicinity of a nursery and to enforce measures for the control or suppression of white-pine blister rust. Areas covering nearly half the State, including all national forests and national-forest purchase areas, have been designated as control areas within which currant and gooseberry plants may not be planted without written permission of the department of conservation. For further information address the State Entomologist, University Farm, St. Paul, Minn.

MONTANA

The cultivated black currant (*Ribes nigrum*) and its varieties are declared a public nuisance, and it is unlawful for anyone to possess, propagate, ship, or sell these plants. Whenever the Governor of the State has reason to believe that any plant disease inimical to the agricultural industry exists within the State, it is his duty to prescribe and enforce such regulations as may be necessary to circumscribe, eradicate, or control it. For further information address the Division of Horticulture, Department of Agriculture, Missoula, Mont.

NEW HAMPSHIRE

The entire State of New Hampshire, except a small uninhabited district in the extreme northern part of Coos County, has been designated as a control area. No one may plant or possess currant or gooseberry bushes in the control area, and it is the duty of every landowner to destroy these bushes. The State forester is authorized to remove or destroy any such bushes from any public or private property. The State nursery inspector has the same authority as the State forester in the control and eradication of host plants of the blister rust in the vicinity of any nursery within the State. For further information regarding control measures address the State Forester, Concord, N. H., or regarding quarantine regulations, the Deputy Commissioner of Agriculture, Durham, N. H.

NEW JERSEY

The secretary of agriculture or his representative may enter upon lands open or enclosed, to inspect for plant diseases, and if any plant is found infected with a virulent disease that cannot be eradicated by treatment, such officer shall order it destroyed. Should the owner consider himself aggrieved thereby he may, within 3 days, appeal in writing to the secretary of the State Board of Agriculture, Trenton, N. J., stating why the order is unjust, and the appeal committee may, after investigation, reverse, modify, or confirm the order. For further information address the Chief, Bureau of Plant Industry, Trenton, N. J.

NEW YORK

The black currant (*Ribes nigrum*) is declared a public nuisance, and the planting, growing, or selling of this plant within the State is prohibited. Any such bushes may be destroyed by agents of the State conservation commission. Within fruiting-currant districts, which have been established in Chautauqua, Orange, Ulster, and Columbia Counties, the growing of currants for the production of fruit is carried on extensively, and the growing of five-needle pines may be prohibited. Outside of fruiting-currant districts the commission may eradicate five-leafed pine or currant or gooseberry plants, either wild or cultivated, except within nurseries certified to be free from disease. Owners may be directed to remove from their lands currant and gooseberry plants within 900 feet of white pine on land of adjoining owners who have protected their pine from the blister rust. The commissioner has established districts in eight counties and parts of three others, all in northern New York, in which the possession or transportation of currant or gooseberry plants is prohibited. For further information address the Director, Bureau of Plant Industry, Albany, N. Y.

NORTH CAROLINA

In order to prevent the white-pine blister rust from becoming established in the State, the commissioner of agriculture is authorized to set aside control areas whenever he determines that five-leafed pines now growing, or to be planted in a nursery, or for reforestation purposes should be protected against the rust. The commissioner has accordingly given notice that in 24 counties in western North Carolina all wild and cultivated currant and gooseberry bushes are declared a public menace. He and his agents are authorized to destroy them, and no one may take such plants to the area or plant them in it without a permit. The destruction of five-leafed pines in the State is also authorized if they are infected with the rust, or if currant and gooseberry bushes in the vicinity are of more value than the pines, or if the cost of the removal of such bushes would exceed the value of the pines. For further information address the State Entomologist, Raleigh, N. C.

OHIO

The European black currant (*Ribes nigrum*) is declared a public nuisance in Ohio, and it is unlawful to possess such plants or their seed. White-pine blister rust control areas have been established in which currant and gooseberry plants are not permitted to exist within a radius of 900 feet of certain stands of native or planted white pines, or within 1,500 feet of certain nursery plantings of these pines of sufficient value to warrant such protection. The intrastate movement of five-leafed pines is subject to permit requirements. The director of agriculture, through the inspector and deputies, has authority to investigate outbreaks of dangerous insects or plant diseases and to take such action as is necessary to control or eradicate them. For such purpose these officers have free access to any premises in the State, and when any such pests are found, the owner is so notified and requested to destroy or treat the plants. Should he fail to do so within 10 days, the work may be done by the State and the expenses assessed as taxes. For further information address the Division of Plant Industry, Columbus, Ohio.

OREGON

The cultivated black currant (*Ribes nigrum*) is declared a public nuisance, and it is unlawful to grow or distribute this plant in the State. State and county inspectors have authority to abate the nuisance in a summary manner. The State Department of Agriculture has established a quarantine under which currant and gooseberry plants and five-leafed pines may be shipped within the State only under certain restrictions, and has set aside a control area to which these plants may be shipped only under special permission. For further information address the Division of Plant Industry, Salem, Oreg.

PENNSYLVANIA

The secretary of agriculture, through the director of the bureau of plant industry, or his deputies, may enter upon and inspect any public or private property that might become infested with harmful plant pests. The secretary is empowered to prescribe and enforce such reasonable orders as may be needed to carry out the provisions of the law, and under such orders, any trees, plants, shrubs, or other plant material infested or infected with injurious plant pests, if so recognized by him, shall be deemed a public nuisance. He is also authorized to establish quarantines to prevent the introduction and spread of insect pests and diseases of plants and, through the inspection of nurseries, certify all nursery stock sold within the State. For further information address the Bureau of Plant Industry, Harrisburg, Pa.

The secretary of forests and waters, through the chief of the division of protection, or his deputies, may enter upon and inspect any public or private property which might become infected with white-pine blister rust. The secretary is empowered to prescribe and enforce such reasonable orders as may be needed to carry out the provisions of the law relating to this tree disease, and under such orders any white pines or currant or gooseberry plants infected with the rust shall be deemed a public nuisance. Any such plants not infected with this disease may also be destroyed by the department where necessary. Control areas comprising 44 counties in the State and parts of two others have been established

to prevent the spread of white-pine blister rust. It is the duty of every landowner to destroy currant and gooseberry plants in these areas, and their further planting is forbidden except under permit from the department. For further information address the Department of Forests and Waters, Harrisburg, Pa.

RHODE ISLAND

Blister rust is declared a public nuisance, and the State director of agriculture and conservation has authority to make such rules as are deemed necessary to exterminate it, including the destruction of diseased or exposed currants and gooseberries and diseased or exposed five-leafed pines. The director and his agents may enter upon any private or public lands in carrying out their purpose. The director has ruled: (1) That the cultivated black currant (*Ribes nigrum*) is a public nuisance, and it is unlawful to plant, possess, or sell this plant in the State; (2) that no currant or gooseberry plants of any kind may be planted or possessed in certain towns set aside as blister-rust control areas. Outside of these areas any stands of five-leafed pines of 1 acre or more may also be declared control areas and the growing of currants and gooseberries within 900 feet of the pines may be prohibited in the discretion of the director; (3) that the transportation or planting of five-leafed pines and currant and gooseberry plants in the State is prohibited except on permit. For further information address the Chief of the Division of Entomology and Plant Industry, 310 Statehouse, Providence, R. I.

VERMONT

The commissioner of agriculture may use such means as are deemed necessary to exterminate or prevent the introduction of threatening or unusual fungus diseases. He may designate and take control of certain areas to prevent the spread of a plant disease and, within such areas, may destroy the host of any plant disease. He or his agents may enter upon public or private land in the performance of their duties. All parts of the State of Vermont within 900 feet of any stands of white pine, either natural or planted, and the area within 1,500 feet of the boundaries of the State Forest Tree Nursery at Essex Junction Vt., are designated as white-pine blister rust control areas, and the planting of currant or gooseberry bushes within them is forbidden. (Notice dated December 6, 1932.) For further information address the State Forester, Montpelier, Vt.

VIRGINIA

White-pine blister rust is declared to be especially dangerous, and the State entomologist is directed to prescribe the nature and method of treatment of all plants so affected. A quarantine prohibits the "dissemination, growing, or other uses" of currant and gooseberry plants in the mountainous region of the State and counties bordering thereon. The movement of five-leafed pines within this area is prohibited except under permit. This quarantine shall operate to permit representatives of the department of agriculture and immigration to enter all premises and to destroy all currant and gooseberry plants growing thereon, except that in the case of the cultivated species the destruction is limited to those within 1,500 feet of white-pine stands. For further information address the State Entomologist, 1112 State Office Building, Richmond, Va.

WASHINGTON

Cultivated black currants may not be planted, grown, or shipped within the State. It is the duty of every owner, lessee, or occupant of land on which any horticultural plant exists to use sufficient means for preventing infection by plant diseases and pests, and in case the plants become infected and cannot be successfully disinfected, to destroy them promptly. This requirement applies to such bacterial and fungus diseases and pests as may be specified as injurious to horticulture in circulars issued by the State Department of Agriculture. The director of agriculture may establish and enforce quarantines and make and enforce such regulations as are in his opinion necessary to exterminate and prevent the spread of any infectious plant disease or weed pest dangerous to any plant or to the plant industry of this State. The director and his assistants are authorized to enter upon any premises to inspect the plants thereon or to carry out the provisions of this act. For further information address the Supervisor of Horticulture, Olympia, Wash.

WEST VIRGINIA

It is unlawful for any person in the State knowingly to permit any insects or diseases dangerously injurious to trees or other plants to exist on his premises unless efforts are made to eradicate them. White-pine blister rust is designated as such a disease, and the commissioner of agriculture is authorized to determine the nature of treatment, including destruction of such plants as may harbor it, and give specific written directions therefor to the owner. The work is done at the expense of the owner. The commissioner of agriculture and his employees may enter upon any public or private property to treat or destroy plants so infected. Under Quarantine Order No. 5, issued January 30, 1934, and amended June 15, 1934, no cultivated black currant plants (*Ribes nigrum*) may be grown or possessed within 1 mile of the bounds of either the Conley State Forest Nursery, Greenbottom, W. Va., or of the Forest Service Nursery, Parsons, W. Va., and no currant or gooseberry plants of any species may be grown or possessed within 1,500 feet of the bounds of these nurseries. For further information address the Department of Agriculture, Morgantown, W. Va.

WISCONSIN

The State Department of Agriculture and Markets has ordered the eradication of all European black currant plants (*Ribes nigrum*) from the State, and no compensation will be allowed the owners for the destruction of such plants. The department may, in its own discretion, or on petition of owners of 10 percent of the land contiguous to a given area, or on resolution of a town meeting, designate control areas for the protection of the white pine. The department has accordingly designated as control areas, zones of 1,500 feet around several private nurseries and Federal nurseries growing five-leafed pines, and zones of 900 feet around all stands of white pine protected from the white-pine blister rust and so posted with the permission of the State entomologist. In the greater part of the State, provision is made for limiting such posting to stands of 10 acres or more of well-stocked white pine, unless the owners of at least 75 percent of the land in the 900-foot zone agree to such posting. All currant and gooseberry plants in control areas must be destroyed and none others planted. Anyone desiring to transport these plants for propagation in the State must attach an official warning tag to be furnished by the department for intrastate shipments, or a Federal control-area permit tag, Form 415, for interstate shipments. The department may destroy white pine trees growing within 1,800 feet of currant and gooseberry bushes infected with the midsummer stage of the blister rust when such action appears necessary to control the spread of the disease. For further information address the State Entomologist, State Capitol, Madison, Wis.

INFORMATION ON FEDERAL QUARANTINE REGULATIONS

(For guidance of persons buying or shipping currant or gooseberry plants)

INTERSTATE SHIPMENTS

(Federal Quarantine 63 with revised regulations effective March 1, 1937)[12]

Anyone desiring to move currant or gooseberry plants from one State to another should first obtain full information as to Federal Quarantine 63. Extracts from the revised regulations supplemental to the quarantine are quoted below, but since they are subject to change from time to time, information as to up-to-date requirements should be obtained before making shipments.

REGULATION 3. CONTROL OF MOVEMENT OF CURRANT AND GOOSEBERRY PLANTS

(*a*) No European black currant plants (*Ribes nigrum*) and no plants of the wild native western species known as *R. bracteosum* and *R. petiolare* shall

[12] U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE. WHITE-PINE BLISTER RUST QUARANTINE. U. S. Dept. Agr., Bur. Ent. and Plant Quar., Quarantine 63, 6 p. 1937.

be moved or allowed to be moved interstate in the continental United States except into or within the area comprised in the States of Alabama, Arkansas, Florida, Kansas, Louisiana, Mississippi, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas.

(*b*) No currant or gooseberry plants of any species or variety shall be moved or allowed to be moved interstate from an infected State or district[13] unless they have either been dipped (except the roots) immediately prior to shipment in lime-sulphur solution of a strength of 4.5° B.[14] or are shipped in a dormant and defoliated condition. Such lime-sulphur dip shall be plainly visible on said plants and be easily detectable by odor, the judgment of the inspector to be final as to adequacy of the dip and as to the condition of the plants as to dormancy and defoliation.

(*c*) No currant or gooseberry plants of any species or variety shall be moved or allowed to be moved interstate into any of the States of Connecticut, Idaho, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Ohio, Pennsylvania, Rhode Island, Vermont, or Wisconsin unless the container shall bear on the outside thereof a control-area permit issued by an inspector designated to act for the Bureau of Entomology and Plant Quarantine in such State. [See address under the summary of laws of the State concerned.] Such permits may be issued on condition that the plants are destined for points outside the legally established blister rust control areas of the States concerned.

(*d*) Except as provided in paragraphs (*a*) and (*c*) hereof, currant and gooseberry plants may be shipped from noninfected States to any destination without restriction under these regulations.

REGULATION 4. MARKING REQUIREMENTS

(*a*) Every car, box, bale, or other container of articles for which certificates or permits are required by these regulations shall be plainly marked with the name and address of the consignor and the name and address of the consignee, and shall bear attached to the outside thereof the proper certificate or permit issued in compliance with regulation 2 or 3 hereof.

(*b*) The certificates or permits in the case of carload and other bulk shipments shall accompany the waybills, conductors' manifests, memoranda, or bills of lading pertaining to such shipments.

White and other pines bearing their needles in bundles of five are also under quarantine regulation. Automobile tourists and others are urged to cooperate in the control of white-pine blister rust by refraining from transporting such pines unless the legal restrictions are complied with. The movement of these pines out of infected States[15] is prohibited except under permit; and movement out of all States is permitted only if a valid nursery-inspection certificate accompanies the trees.

No one should move or ship currant or gooseberry bushes or white or other five-leafed pines from one State to another without consulting the latest revision of Federal Quarantine No. 63, a copy of which may be obtained from either the Bureau of Entomology and Plant Quarantine, Washington, D. C., or the State nursery inspector.

IMPORTATIONS FROM FOREIGN COUNTRIES

Importation of currant and gooseberry plants and five-leafed pines into the United States is restricted by the provisions of regulation 14

[13] Connecticut, Idaho, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, West Virginia, Wisconsin, and the District of Columbia are designated as infected with white-pine blister rust, in the regulations of this quarantine.

[14] Prepare this solution by diluting 1 part of commercial concentrated lime-sulphur solution of 32° B. with 8 parts of water.

[15] Connecticut, Idaho, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, West Virginia, Wisconsin, and the District of Columbia are designated as infected with white-pine blister rust, in the regulations of this quarantine.

of Federal Quarantine No. 37, the nursery stock, plant, and seed quarantine. Prior to September 1, 1936, these plants were prohibited entry from Europe, Asia, the Dominion of Canada, and Newfoundland, but their entry is now regulated in harmony with the restrictions of Federal Quarantine No. 63, the domestic white-pine blister-rust quarantine.

Also, Federal Quarantine No. 37,[16] as revised and amended, controls the entry of nursery stock and other plants and seeds, with a few exceptions, from all foreign countries into the United States.

[16] U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE. NURSERY STOCK, PLANT, AND SEED QUARANTINE. U. S. Dept. Agr. Bur. of Ent. and Plant Quar., Quarantine 37 with regs. rev. 1935. Reprinted 1936. 11 p.

U. S. GOVERNMENT PRINTING OFFICE: 1938

For sale by the Superintendent of Documents, Washington, D. C. - - - - Price 5 cents